

# LISTINGS NEWSLETTER

Newsletter of the  
Long Island Sinclair/Timex  
Users Group  
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DOUBLE ISSUE

Issue: APRIL & MAY 1996

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Next LIST meeting June 9th, 1996

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Mr. Harvey Rait  
5 Peri Lane,  
Valley Stream, N. Y. 11581

COMING EVENTS: The next L.I.S.T.  
meeting will be Sunday 6/89/'96  
at 2 P.M. at the home of Harvey  
Rait (see address above).

## Listing Policy

Annual Dues \$16.00

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I really got ticked off last week. Last year I had written about the year 2000 problem that will face many computer problems when the new millenium starts in 3 years. Basically I thought that it might only affect programs that used time/date headings or storage identifications. Last week because of the April 15 tax due date there was a rash of stories in all the media of the 2000 problem. The high point of my ire was a televised Senate hearing on CSPAN. This so called committee of computer industry gurus had the nerve to tell our Congress persons that it will cost anywhere from \$60 billion to \$600 billion to make the necessary changes in the programs that are in use now. My dear friends that is no typo the dollar amount is in Billions according to their report. They claim that every line of programming has to be gone through at \$4 to \$8 per line. Earlier programs they claim were never documented and that 3 out of 5 software companies will not be around to make their own changes. The industry is looking for a Federal bailout for their ineptitudes as well as a golden calf (evidently left over from the story of Exodus aired last month).

Let us be reasonable, the number of programs that will be involved is miniscule compared to all the programs that are currently in use. They spoke of actuarial tables of insurance companies, banks and perhaps historic research. Big deal, that should be their problem not ours.

First a show of hands. How many 100 year old people will be alive to be even remotely involved? How many insurance policies or bank accounts have to be calculated for 100 years? There really are so few that you would have to go to extraordinary lengths to even identify them.

Okay, so be that as it is here is my typical cheap and dirty fix :

Instead of calling the year 2000 call it 200\*, since it is the last 2 digits that they claim will cause all the problem identifying itself as 1900. When the digits 0\* appear a quick subroutine would put it in the proper perspective and straighten out any confusion factor.

I am not a programmer and I am not a maven on machine code, COBOL, FORTRAN. I am however a quick study in bullcrap, and that was what I was hearing for hours on and by these dark suited mendicants holding out their hands to the public coffers.

Now I suggest that the Sinclair community jump in and volunteer to do the job at 1/2 price. I think that we should be able to increase our treasuries by a few billion bucks, and get a lot of free publicity besides. Do I hear a loud "Here, here" from our QUANTA people?

Maybe this rambling will start a ground swell. Please write your comments to me at LIST, write a letter to the editor of your local newspaper, or if you have the -er, shall we say cullions in the vernacular, contact your legislative body. My choice is my congressman Al D'Amato. He can make as big a deal out of anything. No comment on "Whitewater". I can't afford to get him angry at me.

Harvey Rait, LIST President

5 Peri Lane

Valley Stream, N.Y. 11581

USA

## QL CORNER

This morning I received a call from Bob Dyl. Bob had a massive heart attack several weeks ago and his doctor strongly advised Bob not to do any work for at least one year!

After the telephone call, I started to recall the events that had started some fourteen years ago when Bob opened up shop, which he called "The English Micro Connection", catering to the Timex/Sinclair 2068 and the Spectrum computer. We had many lengthy conversations in the early morning, perhaps three or four times per week. When the QL was born and A+ Response (in the USA) sold QL computer kits, Bob felt that this was the way to go. Later on, Bob started a small newsletter which blossomed into the IQLR magazine.

Bob had not only published IQLR for some four years, he also accomplished something else, the birth of QL Shows in the USA. I recall Bob told me that when Stuart Honeyball of Miracle Systems returned to England from show number one in Newport, RI, some of the British QL users asked him "why would you go to the United States for a QL Show?" and Stuart replied "The US QL users know how to use the QL and they have purchased quite a few hardware products from his company and from Tony Frishman (TF Services) and Bill Richardson & Co. (ECC)". In less than one month from this date of writing, I will attend the fourth annual QL Show in Bedford, Mass. If it wasn't for Bob Dyl starting the QL revolution in the USA, who knows what shape we would be in at this time... QL wise!!

Anyway, if you have a few spare minutes when you go shopping, why not stop at a card shop and purchase a "get well" card and mail it to Bob to show your appreciation for what he had done for us and our favorite computer. Also, we are no longer mentioned in Europe as those Yanks "from across the pond". It seems that we have gained some respect from the rest of the world.

Several hours ago, I received Jochen Merz software catalog and under the QL News he makes much mention of the US QL Shows.....

### MEETING USA

"The last QL show in the USA was superb, as everybody who was there can confirm. And it was not only the show itself, it was the "before" and "after" as well - partially connected to the QL and partially not. However, going to the USA is really worth it!

Everybody who is interested in going should book the flight as soon as possible. In case you do not know of cheap flights, I can give you the address of a travel agency where I booked: flight starts at Amsterdam Airport, DM 799; (plus US tax) with United Airlines. Staying there is cheap as well (not only shopping etc.), a double room at the Ramada Inn is only \$49.00 per night!

All the famous people will come: Miracle, COWO, Mechanical Affinity & Update Magazine, Wood & Wind Computing, QBranch, QL Hacker's Journal, and TF Services, QUANTA, ECC, Albin Hessler, Di-Ren, all plan to come. So why not combine your holiday trip with a visit in the USA and the QL Show?" Jochen says it all!

Tim Swenson author of the "QL Hackers Journal" has taken it upon himself to distribute QL Freeware/Shareware to North American QL Users since there are no US distributors offering such software. Send Tim a SASE for his catalog of approximately 85 programs, all in compressed

format (\_zip, zoo and \_arq). Tim's address: 5615 Botkins Rd., Huber Heights, OH 45424 and his telephone number: 513-233-2178 or <http://www.serve.com/swensont/swensont@mail.serve.com>. These freeware files are also available on QBOX-USA, 810-254-9878, 24 hours, 300 - 14400 Baud. I am pretty sure that Tim will attend the QL Boston show in May '96.

WOW! 256 colors for the QL

I am copying the editorial for the April issue of QUANTA into this issue of QL Corner. "I've seen the light! Well, more like 256 colors to be exact, all emanating from a QL. Admittedly it was only a test-screen, since the color screen drivers are still in development, but the prototype board did demonstrate the feasibility of the forthcoming QUBBESoft/Nastasic QL color graphics card (did I hear the name Aurora mentioned?). Zeljko Nastasic demonstrated the prototype board at the Bristol Workshop along with another board driving an Liquid Crystal Display (LCD) screen. Both were plugged simultaneously into a topless QL via QPLANE. The prototype board was put through its paces with the standard QL colors driving monitors at a variety of resolutions, stunning stuff!"

It is my understanding that Zeljko Nastasic has a small prototype QL motherboard or is working on one. The QPLANE is a companion PC board which connects to an IBM power supply and I believe the serial ports and perhaps the mouse ports as well as the networking ports are also connected to this board. If Zeljko's QL mother board is anything like the QPLANE and Hard Drive interface, he will have a winner.

During the past few months I have ordered several selected programs from Frank Davis (formally Mechanicle Affinity), now FWD Computing. QPAC2 has been upgraded and it will probably arrive shortly. Open World (Ergon Development, Italy), allows the QL to import graphic images created on other computers. Think about the possibility of reading files created with Amiga (\_IFF), and \_TIF (Adobe format) and \_GIF (Compuserve). Before you can convert these files to QL format (\_scr), you must have a program which will convert files in MS-DOS (and Atari DOS, Amiga and MACintosh) such as Discover or Multidiscovers. There is an additional feature called PIC\_screen cut and will be saved in Pointer Environment format which can be loaded into applications which support this format.

The program comes with quite a few GIF, IFF and TIF files converted from their native computers so that the user can use the Open World utility. What makes this software better than most programs (such as UNGIF or SHOWGIF), because when you select the screen type such as GIF, the program reads a file on flp2\_ and displays all GIF files on the disk (as well as TIF and IFF files). So what is so great about this? Well, how many times have YOU forgotten a file name when you want to load a file into memory! The menu will display all of one type of files and to select the file you want to convert it to a QL screen (\_scr), just press the letter or number on the menu corresponding to the file you wish to convert to QL format.

The program is menu driven with each function on a separate line. The current function will be highlighted with a white border around the scroll bar. This is not a PE program, however, each function can be selected with the up/down cursor keys or by depressing a letter or number corresponding to a menu item. The Open World manual is informative and provides adequate information for the novice QL user and is written in English. If the program is updated, the original owner can send Ergon the original disk with 4 IRC's (purchased at your local Post Office). See you next month.. Bob Gilder

THE NEW ENGLAND SINCLAIR USER GROUP - (NESQLUG)  
HOSTS

THE FOURTH NORTH AMERICAN QL SHOW  
"QLBoston"

Saturday, May 18th  
From 9 AM until 5 PM

The show will be located in Bedford, Massachusetts, just 15 miles NW of Boston. Bedford, and the two bordering towns of Lexington and Concord, contain many historical sites and museums, including the sites of the first battles of the American Revolution, Minuteman National Park, the Lousia May Alcott house, Walden Pond, the Henry Thoreau house, and many others.

The QL Show will be held at the:

Bedford Ramada Inn, 340 Great Road, Bedford, Massachusetts 01730  
Tel: In US (800) 228-2828 or (617) 275-6700  
Fax: (617) 275-3011

A block of rooms has been reserved for Friday and Saturday the 17th & 18th of May, 1996, for those attending the show, at a reduced price of just \$49 per night - 1 or 2 persons, and \$10 more for an additional person. The price also includes an 'all-you-can-eat', American style buffet breakfast. Please mention the 'QL Show' when you call, in order to get this special rate.

Additional nights are \$59 per night, for 1 or 2 people. Rooms must be reserved not later than April 27th, three weeks prior to the meeting.

If you reserve a room at the Ramada Inn by April 27th, you may pay the \$5 entry fee at the show. If you don't plan to stay at the Ramada, please send a \$5 check, by Mat 10th, to:

Garry Norton, 43 Richardson St., Billerica, MA 08121 USA  
E-mail: norton@prevline.health.org Tel: (508) 667-2048

Contact Garry, if you would also like a packet of maps and tourist information. The entry fee, on the day-of-the-show, will be \$7.

THE AGENDA

Friday, 17 May (optional)

Meet in the Ramada Inn Lounge at 7PM, and share rides to the Willow Pond Restaurant in Concord, an informal pub that offers meals starting under \$5 and twin lobster dinners for \$14.95.

Saturday, 18 May

8:00 AM Meeting room, on the 3rd floor of Ramada Inn, opened to vendors.  
9:00 - Noon General Meeting - Coffee and tea will be provided.  
Noon - 1:00 Meeting room closed for lunch break. (\*)  
1:00 - 4:30 General Meeting.  
4:30 - 5:00 Vendors remove equipment from room.

Numerous valuable QL hardware/software doorprizes will be given away all day!

(\*) NOTE: Only sandwiches are available for Lunch at the Ramada Inn, but there are a variety of eating places within 500 yards of the meeting location.

## The Saturday Night Banquet

The cost is \$19.95 and seating will be limited to the first 60 people making reservations. Contact Garry Norton to reserve your seat, not later than May 10th. If you stay in the Ramada Inn, you may pay for the Banquet when you arrive. Otherwise, please send a check, made out to Garry Norton, also by May 10.

6:00 - 6:30 A reception - 2nd floor Banquet Room, Cash Bar (open all evening)  
6:30 - 7:45 The QL Banquet

### THE BANQUET MENU

Fruit cup and Garden salad

with your choice of:

Broiled Boston Scrod (a tasty white meat fish)

OR

Baked Chicken with Supreme Sauce

with:

Rosted Potatoes and Green Beans, Almondine

and

New England Shortcake with Strawberries

7:45 - 7:50 Awards Presentation

7:50 - 8:00 A QL Quorum - a panel of knowledgeable volunteers will (try to) answer your questions from the floor, and offer opinions.

Evening ends with folk song sing-along, general discussions, and elbow bending until they throw the stragglers out at midnight.

Sunday, 19 May

9:00 AM - ? QLunch at Dorothy and Al Boehms', 33 Selfridge Rd., Bedford.  
Several QLs and QXLs will be set up in separate rooms for demo's and discussions. Coffee, tea and donuts in the morning. Cold cut buffet sandwiches, for lunch. Leave only when you have to.

The following vendors and QL notables have indicated they are planning to come:

Stuart Honeyball .... Miracle Systems  
Jochen Merz ..... Jochen Merz Software  
Urs Konig ..... COWO Electronica (Switzerland)  
Frank & Caril Davis . Mechanicle Affinity and Update Magazine  
Bill Cable ..... Wood and Wind Computing  
Roy Wood ..... Q Branch  
Tim Swenson ..... QL Hackers Journal  
Bob Dyl ..... IQLR

Others that are trying to make arrangements to come include:

Tony Frishman and Lou Reeves  
John and Val Taylor - from Quanta  
Bill Richardson - from W. N. Richardson & Co.  
Albin Hessler - from Albin Hessler Software.  
Bill Cable is the designated vendor, 'point-of-contact'.

RR3, Box 92, Cornish NH 03745 USA  
Email: bcab@prevline.health.org Tel: (603) 675-2218



This an article that appeared in Newsday April 14,1996.

It was written by Lou Dolinar who has written many fine articles on computer topics. This however is another boondoggle by the computer industry. We in our little world of Sinclair have learned to conserve our ROM, RAM and storage facility by the necessity of having rather low power devices.

"Maybe it is early to start printing up the bumper stickers that say 'Conserve bandwidth-'Netsurf with a friend.' But if John Michael Keyes has his way, that day is not too far off. Keyes , a a graphic artist, wants to stop Web-site designers from wasting space and tying up the Internet's file servers, routers, fiber-optic backbones and your own little modem with corpulent photos, potbellied artwork and Rubenesque logos. To that end, he's started his own Web site for 'The Bandwidth Conservation Society,' to trai others in cyberdieting and digital liposuction!"

"Typically you can take thirty to fifty out of a graphic file without affecting quality a bit," he says. "Just that would have a huge impact on some of the traffic on the Intrnet." The less data the the 'Net has to move, the faster Web sites load-a real consideration judging from the increasing speeds many are experiencing. Of course, you can do the same thing for yourself if you don't download graphics-an option on most browsers.

Keyes is not suggesting that anyone reduce the number or the dimensions of photos, although that might not be a bad idea, either. His point is that many trendy young Web designers don't understand the basics of how color and photos work on a computer, which is what his Web site (<http://www.infohiway.com/way/faster>) is designed to teach through an interactive tutorial. Why make your artwork more fruga? AS he writes in the tutorial: "The bottom line is the surfing syndrome. AS dial-up population grows, more folks want the images faster. Plus...by reducing the size of images a few things occur: 1)The developer uses less hard disk real estate. 2)The developer uses less CPU (computing power) overhead to deliver the image. 3)The user gets the image quicker! (this is the important one)

4)Fewer bytes accessed means more as the popularity of the 'Net grows.

5)Courtesy. As more folks are sharing Web-server resources, your electronic neighbors will appreciate your intelligence and Web-savvy delivery.."

The basic strategy he outlines on his site involves reducing the number of colors in artwork. Image-editing programs like Photoshop accomplish this fairly simplt, he says. The tricky part is figuring out how much color can be thrown out while maintaining quality, and learning techniques that mask the tricks. Some of this is a matter of aesthetics, as in showing how to make a svelte gray background look as good as a more colorful one.

The Bandwidth Conservation Society is another one of those things that started as an in-joke six months ago on the 'Net and has since acquired a life of its own. Keyes firm, World Access of Boulder, Colo., was sharing a file server with - and suffering the consequences of- another company's bloated pages. His customers were complaining about access times. "No one likes to hear that they don't what they're doing when

they design Web pages, so I had to think of a diplomatic way to call their attention to the problem."

Thus was born the page and the Bandwidth Conservation Society. Since then, thousands of people have stumbled onto his Web site, which now hosts a large and active discussion group about ways designers can shrink and speed up their graphic files."It is about to become an honest organization. I'm sorting through five months of e-mail, and we've got a couple of dozen regular contributors who will help run it. We'll also ask people to contribute something before they can call themselves members-not money, but intellectual contributions, or put our logo on their Web page."

Increasingly, Keyes finds the group is getting aggressive about ridiculing bandwidth wasters. It has begun hotlinking to particularly lavish sites, naming, for example, The Discovery Channel, with a home page that can take minutes to load, as among particularly egregious "Dogs and Hogs." There are also hotlinks to sites using various techniques to speed up graphics.

Says Keyes, who also teaches graphics design at the Colorado Institute of Art, "It's been fascinating to see how something like this (his page) contributes to the world's knowledge of the subject. The newest, greenest people can usually give a veteran something they didn't know. I've learned five or six new tricks from the forum." \*\*

Lou Dolinar can be reached at Newsday, 235 Pinelawn Rd., Melville, N.Y. 11747-4250 or by e-mail to :  
Dolinar@aol.com or pluggedin@prodigy.com.

HR comment- another bit of fascinating news that the Sinclair world has known about since Spectrum days.

#### RAIT'S RAMBLINGS (AGAIN)

SOME OF THE BEST WRITING AND OBSERVATIONS THAT I DO ARE IN THAT PERIOD OF NOT HAVING QUITE FALLEN ASLEEP YET.

For the past few weeks I have been taking a medication that causes me to wake every hour or so to micturate. So I have 6 or 7 presleep periods to ruminate as to what I would like to write in a column. Unfortunately as you all know a lot of the best stuff like a dream is not reliable in the morning.

I received the Spring edition of ZXir QLive Alive the other day and was surprised to see 1) Doug Wagoner of Post Fall, ID is still looking for Timex Sinclair and T-S Horizon issues that I had already told him I had and was willing to send to him. He never answered me. If he is notified of this or reads this, he can contact me again and I will see if I still have what he wants. I think that spot in ZXir has been running about 6 months.

Then ZXir had a letter from Peter Liebert-Adelt to Abed Kahale asking if he knows Harvey Rait from LIST, because he wrote twice to get information about LIST. "Are they out of work like SYNC-LINK?"

Because of the large amount of correspondence that LIST gets not all of the responses are made by me personally. LIST has a staff of members that are assigned the role of responders to inquiries. His inquiry could have been answered by someone



else. Of course LIST is not out of work. List is still one of the most active user groups still in publication and active in the TS world.

Next item. I have before me three very interesting newsletters. They are called RAMBLINGS ,the Timex Computer Club Newsletter. Dates-Vol 1, Number 2, April 1983-Vol.1, Number 3, May 1983- and Vol 1, Number 4, June,July,August 1983. These extremely rare publications are going to made available for sale to anyone that is into TIMEX/SINCLAIR memorabilia. As we say in the trade "Make me an offer". Proceeds go to the LIST treasury.

A lot of TS user groups started in 1983 (at the urging of the Timex Corp.) including LIST. I decided to do some house cleaning of my desk drawer and I will definitely get rid of stuff. Nostalgia aside, you cannot save everything. Those are my wife's words not mine. But she is right. So- what goes and what stays?

6 page LIST newsletter #3-1984 Paul Donnelly editor.TS programs and tips.OUT.  
TS 2040 Personal Printer Operating Manual.SAVE.  
TS-2068 Guardian program instructions.SAVE.  
Letter from Doug Dewey to Paul D. 1984 discussing the developement of the Spectrum emulator for the TS-2068.OUT.  
LIST Printer information. 16 pages of general and pointed information of printer useage related to Timex and Tasword , and various printers that were around in 1984.SAVE.  
Breaking into the Transylvania Tower and how to shift RAMtops.OUT.

FIRST LOADR.Lets you upload your TS1000 programs into the TS2068.OUT.

Patches for the Zebra Joystick adaptor.OUT>

OMNICALC2 instructions.SAVE.

Modem schematic.OUT.

Pokes for TASWORD TWO using the AERCO printer interface.Reprint in newsletter then OUT.

Technical Analysis I instruction manual for TS2068 program for stock investing.1983 by T.H.Nooter.SAVE.

Old correspondence.Letters in all sorts of formats especially TS 2040 paper .Names from the past and some still out there.

1987-DonLambert.JoanKealy."Phoenix"Petefisher..Cedric Bastiaans.Bill Harmer.Andy Kosiorek.Bill Pederson.Ed Burton. OUT.

1986 catalogs from SHARPS.KNIGHTED.VARIETY SALES.HACKSEL ELECTRONICS.OUT.

Membership lists .OUT.Note-Bob Malloy was member #4,Bob Gilder was member #14,Harvey Rait was member #17.We had 60 members 11/87.

Folder full of library tape directory listings.These tapes are still available for the TS1000 and TS2068.SAVE.

Meeting minutes from 1987 when I was recording secretary.OUT.

A+Computer Response invoice for my QL.Dec.1986. I forgot I paid \$201.14 for it.Since it's out of warrantee.OUT.

Larken Disk Drive operating manual 10 pages.SAVE.

Brothers EP-44 cassette ribbons.3 1/2 discs,5 1/4 disks.Envelope full of stick on labels.SAVE.

New York City Subway Map.SAVE.

## RAIT'S RAMBLING (AGAIN)

1985 back issues of T-S Horizons and Time Design. Temporary SAVE.

Oh well some progress made. Next project is the bookshelves piled high with paper printouts, old newsletters etc. I can't believe I have accumulated so much stuff. But 10 years is a long time especially if you have been active in the running of LIST.

### HARVEYS Tips

The following pokes were provided by Phoenix Enterprises for TASWORD TWO using the AERCO Printer Interface. These pokes provide the necessary changes to the TASWORD TWO printer driver.

Load Tasword as usual.

Enter load/save/print menu and press 'B' to enter basic.

Input each POKE.

POKE 57578,32

POKE 57579,12

POKE 57999,127

POKE 58000,230

POKE 58001,19

POKE 58002,254

POKE 58003,1

POKE 58004,32

POKE 58005,8

POKE 58006,241

POKE 58007,211

POKE 58008,127

POKE 58009,0

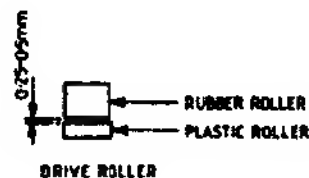
POKE 58010,219

POKE 58011,127

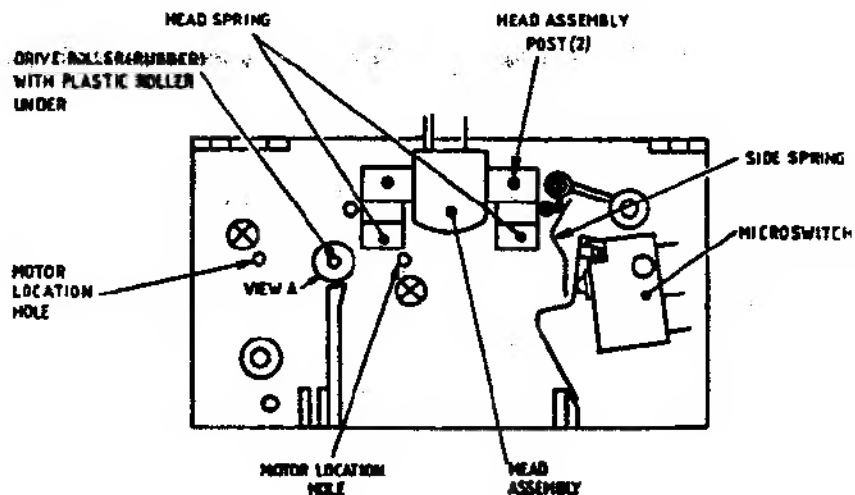
POKE 58012,201

From the Supra Users Group in North Carolina. Doug Dewey gives this tip, dated Dec 12, 1986.

In regard to the micro-cassette on the QL. Check your rubber roller/plastic roller gap and adjust. I put a tiny drop of super glue on top of the roller to secure it. See figure.



VIEW A



[This modification to the TS100 for enhanced speed was downloaded from COMP.SYS.SINCLAIR on 22 May 1995. He, in turn, 'downloaded' it from an unspecified old club newsletter; the original author seems to be Anthony W Farrell. Slightly edited for clarity. Mr Graham is at TG@TELEPORT.COM.]

The whole idea of experimenting with a "Turbo Switch" came from reading the book "Explorer's Guide to the T/S1000" by Mike Lord. On page 58 of this book under the heading "Keyboard Scanning" he tells how the system variable MARGIN may be changed from 55 to 31 by taking pin 22 of the ULA chip HIGH or LOW. This is supposed to be of use to the computer manufacturer to enable the 1000 to be used in either the USA which uses 31 blank lines at the top and bottom of the screen, or in the UK which uses 55 blank lines. The book also states on page 53 under the heading "NMI Handler" that "When in the SLOW mode the ZX81 uses the time occupied by these blank lines to carry on with your program."

So I thought that if I increased the number of lines on my 1000, I might increase the speed of program execution. And it works well. I use direct video and have not tried it using the RF modulator, but if you use direct video I think you will have success from the modification.

To test the speed of program execution I use the following BASIC program:

```
10 FOR N=1 TO 500
20 NEXT N
30 PRINT "FINISHED"
```

With pin 22 HIGH the computer takes 20 seconds. With the pin LOW the program takes 28 seconds. This is a considerable increase in speed. One might ask "Why have a TURBO Switch?". Well, when I use my WORD\* program at the "Turbo" speed the cursor blinks at about twice the normal rate and does not seem to miss keys as it did in the past, and when playing games I use the slower speed so that I can get a higher score!

When using the higher speed I find the monitor screen is filled with lines from top to bottom, when using the slow speed I find a blank screen at the top and bottom 1/2 inch of the screen. I can switch from "Turbo" to normal at any time without any crashes.

Lastly, how is the modification carried out? You have to take the T/S1000 circuit board out of its case and locate resistor R30 which is located between the ULA chip and the regulator heat sink. It should have the colors Brown Black Brown (100ohms).

Using a soldering iron, lift the left hand end of the resistor clear from the circuit board hole. Also locate resistor R33 which is four resistors down from R30, and solder one end of some two core cable to the left hand end of R38, which should be a 5V rail. To the raised left end of R30, solder one end of a 1K 1/4W resistor. Bend the resistor upwards and solder the other end to the right hand end of R34, which is a 0V rail. To the junction of R30 and the added 1K resistor solder a switch of the single throw single pole type.

That completes the circuit board modification. Try connecting a multi meter at the solder connection between R30 and the 1K resistor, and ground. When the 1000 is powered up, the "Turbo" switch should change the voltage from nearly 0V to nearly 5V, and if you have your monitor connected you should see the screen flicker.

The switch should be mounted somewhere convenient, accessible from outside the T/S1000. I have my T/S1000 mounted inside a steel chassis and so I mounted the "Turbo" switch on the front panel with the words "TURBO" and "NORMAL" along side the switch. Try entering and running the program that I LISTed earlier and see the difference the switch makes.

Hi Spec-chums,

Just a quick NVG update, which today is of special interest if you're a QL user.

As usual, FTP to ftp.nvg.unit.no, cd to /pub/sinclair, and the files are as follows (format: filename, followed by directory) :

QL New Stuff

-----  
So much new stuff here that I've created four new directories for the QL. Many thanks to the uploader (who also provided the descriptions below!) :

BATTLE.lzh	Game	ql/games
BForth0594.lzh	Forth	ql/languages
BlackHole.lzh	NUL device	ql/utils
CAVERN.lzh	Game	ql/games
CrazyCard.zip	Game	ql/games
CueshellDemo.lzh	Demo of Cueshell	ql/demos
DEA520demo.zip	Demo of DEA disassembler	ql/demos
DECIPHER.zip	Game	ql/games
DM5demo.zip	Demo of Disk Mate 5	ql/demos
Dbas.zip	Database programming extensions	ql/utils
DbasUpdt.zip	Updates (bug fixes) to the above	ql/utils
Dhrystone.lzh	Benchmark	ql/utils
Doctor4.lzh	Disk repair utility	ql/utils
ExplAtoms.zip	Game	ql/games
GF6AP.zip	!	ql/languages
GF6GF.zip	! Forth	ql/languages
GF6T1.zip	!	ql/languages
GF6T2.zip	!	ql/languages
GRABIT430.zip	Image grabber	ql/utils
History123.lzh	Hystory device	ql/utils
Indent18.zip	C source indenting utility	ql/utils
IndexDemo.zip	Demo of an indexing prog	ql/demos
MCRON107.lzh	Mini cron v1.07	ql/utils
MathBench.lzh	Math benchmark	ql/utils
MineSweeper.zip	Game	ql/games
Monopoly.zip	Game	ql/games
PD3Demo.zoo	Demo of Page Designer 3	ql/demos
Prolog.lzh	Prolog	ql/languages
Prolog.zip	Another Prolog	ql/languages
QLWAR.lzh	Game	ql/games
QPatch101.lzh	QLiberator utility	ql/utils
QSpreadDemo.zip	Demo of QSpread (spread sheet)	ql/demos
SFormat1E5.lzh	Super-Format v1.5e	ql/utils
StarButton.lzh	Stardate in a button !	ql/utils
StarTrek.zip	Game	ql/games
T87p4dem.zoo	Demo of Text87plus4 word processor	ql/demos
TOSforQL.lzh	TOS emulator for the QL	ql/utils

These are screendumps of the Open World Utility menus and screen file. See pages 3 and 4 of QL Corner, this issue.

8	Open World
0	Convert GIF file
1	Convert IFF file
2	Convert TIF file
3	View screen
4	Save whole screen
5	Save _PIC screen cut
6	Main device: flp1_
7	Working device: flp2_
8	Transfer to RAM
9	Change border colour

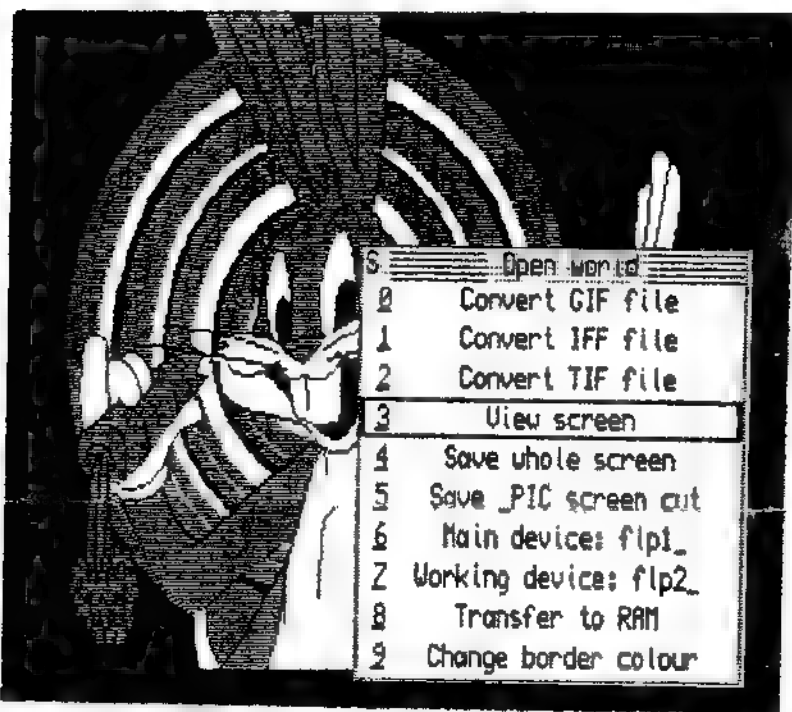
Opening Menu

8	flp2_ GIF
0	BILBO_GIF
1	BUNNY_GIF
2	U-PRICE_GIF

GIF Menu

8	BUNNY_GIF
0	Process file
1	Output: scr_512x256a0x0
2	Loading in MODE 4
3	Dithering OFF
4	X loading offset: 0
5	Y loading offset: 0
6	Set default values

Process Menu



View screen Menu



Screen Dump of GIF file

## SERVICE AND REPAIR DATA FOR SPECTRUM 48K by Chris Owen

[From COMP.SYS.SINCLAIR on 25 February 1995, with minor editing. Mr Owen is at TR95006@SABLE.OX.AC.UK. All the repairs noted here are for skilled gadgeteers. In addition you need the circuit diagram for the instrument to follow the instructions. This is available from LIST. On the other hand you don't have to worry about violating the factory warranty any more.]

I came across the following booklet giving repair data on the Spectrum 48K (the rubber-keyed one!) in the Bodleian Library recently. I photocopied the contents and now I've OCR'd and uploaded them for the readers of COMP.SYS.SINCLAIR.

There are also some diagrams accompanying it - I'll scan and upload those to FTP.NVG.UNIT.NO, hopefully on Monday or Tuesday [back in February of 1995. The diagrams are there now.]

NOTE: I accept \*no\* responsibility for anyone blowing up their Spectrum as a result of this! (I don't know one end of a soldering iron from the other, so I'm relying on the booklet's information being right...) [Mr Owen suffers from badly seared hands.]

-----  
SERVICE DATA  
=====

Modification of earplug: Connect a 330 ohm resistor between signal and earth leads of earplug to allow earplug to be left in place while saving a programme.

Inserting or removing such items as joysticks, especially via a Kempston interface, while the computer is switched on will damage the power resistors and regulator.

Modification to voltage generator circuit: Where not fitted already, insert a 22uf capacitor between the TR4 and D15 as shown in the circuit diagram, this will ensure the correct 12v supply. On early models replace R60 by a 270 ohm resistor and fit C74 if missing. Ensure that the 12v supply is 12v.

Manufacturer's advised modifications: In early versions replace all ceramic capacitors by axial ones and replace C46 by a high-temperature 1uf type. All resistors to be changed to show the second value show in centre pages circuit diagram herein; same applies to capacitors.

Weak sound: Only if particularly noticeable should the sound section be changed to same as shown herein.

Tape and Sound Circuits: 5Vp-p at ear socket for 2Vp-p at IC1 verifies IC1.

Alignment: Only needed for early models. Place meter on pin 4 of IC4 and adjust VR1 to obtain 130mV; adjust VR2 to obtain -75mV at pin 2 with a 20mV allowable error either way. Use TC2 to set colour subcarrier frequency to 4.433619MHz to 50Hz either way. TC1 only helpful to improve screen colour pattern.

Alignment: All models. Run the programme to display the eight colours in sequence from black to white. This is normally given as:-

```
10 FOR A=0 TO 7
20 FOR B=0 TO 3
30 PAPER A: PRINT " ";
40 NEXT B
50 NEXT A
60 GOTO 10
```

If this shows incorrect or missing colours then align as stated for early models. See repair data for later models.

## REPAIR DATA



## 1) GENERAL REPAIR PROCEDURE AND NOTES ON ALL FAULTS

These computers are reportedly very unreliable with some 50% of new ones alleged to have to be returned for replacement. Many faults are due to loose or badly fitted components so that a good checkover is essential for this reason, to determine if a factory failure first.

Check heatsink first for any reported fault, is it loose? Are there overtightened screws? Look for dry joints, cracks in print or cracked boards, badly fitted components, especially ICs; dirty or tarnished contacts, pins, holders, edge connectors; damaged keyboard tails and fins are certainly not uncommon for whatever reason.

Before investigating any fault check any add-ons and interfaces to the computer for broken solder, etc. caused by user wiggling them about. It is also essential to note if add-on is loose or faulty which will give a guide to any damage so caused. This will also determine if fault in add-on not computer. Knowing what add-ons are used can be a good guide to probable fault: for example, suspect TR4 blown and/or destroyed RAMS if a Kempton is used.

Check if customer has been inserting or removing any add-ons without first switching off and point out how this practice has damaged machine and costing him unnecessary expenditure. If this is admitted then check TR4 first then RAMS and see symptom 3.

## 2) WON'T LOAD FROM RECORDER

Almost invariably this will be caused by the alignment of the recorder head not being good enough. The recorder will play music, etc. and function well but it will still need adjusted to operate the Spectrum properly and it matters not whether it is an old or just newly bought recorder.

Disconnect Spectrum from recorder and with any tape playing use a long thin-bladed screwdriver to adjust the azimuth screw through the hole normally provided for this purpose. The object is to obtain the sharpest possible sounding note, noting that if note is in the least muffled sounding then there is no chance of the Spectrum loading from it.

If no hole is provided this should be done with the recorder cover removed. Although it is recommended that volume should be set at midpoint it is far better to vary volume setting to that at which maximum treble is obtained. Finally give head a good clean and recheck setting.

If the adjustment does not cure the problem then save a short programme from the computer (or use one previously saved) and if this doesn't load then it is safe to assume that there is a fault, probably in the computer. In this case, check connections to computer and the circuit from the edge connector to the first I.C.

## 3) NO COIL BUZZ FROM INVERTER, -5V ABSENT

From symptom 1 it should be obvious that TR4 (ZTX650) is very prone to damage and this symptom is a sure indication that TR4 must be replaced. However, before replacing the TR4 check the TR5 (ZTX213) (using a transistor tester is O.K.) and the coil since it is not unknown for all three to have gone at the same time and if only the TR4 is replaced it can fail again immediately if the others are faulty.

Whether or not these three are faulty or not, there can be one or more faulty RAMS as well caused possibly by the same forcing in of an interface during switch on. If all else has been fixed, switch on and check if any RAM gets hot;

replace any very hot RAMS either in basic set or in extra board as this is a sure sign of being short circuit. If open circuit, the quickest way to check is

to by-pass each RAM in turn using a RAM known to be O.K. When so doing the same RAM must be used as the suspect and it should not be removed after each

check for some ten seconds after each switch off or it will fault itself. Use of a 'scope or logic probe is clearly a better alternative if available. Tandy make a good, inexpensive logic probe.

#### 4) DIRECT CHECK FOR A SINGLE FAULTY RAM

-----  
Type PRINT PEEK 23732+256 \* PEEK 23733 (CR). If computer RAMS O.K. the reply is either 32767 or 65535, if less than either this means that there is a shortage of available RAMS, thus one or more RAMS may be faulty.

Call the reply N and if POKE N+1,85 (CR) then PRINT PEEK N+1 (CR) is typed the reply should be 85 if RAMS O.K., in that case type POKE N+1,170 (CR) then PRINT PEEK N+1 (CR) when a different number to the 170 you have just poked into that address will be printed. 85 and 170 are the easiest binary numbers (01010101 and 10101010) to cover all combinations in an 8-bit chip.

Where a different reply is given to either POKE locate the incorrect IC as follows:-

Where 85 is poked in IC6 faulty gives 84; IC7 87; IC8 81; IC9 93; IC10 69; IC11 117; IC12 21; IC13 213.

Where 170 is poked in IC15 faulty gives 171; IC16 168; IC17 174; IC18 162; IC19 186; IC20 138; IC21 234; IC22 42.

#### 5) NO COIL BUZZ FROM INVERTER, REG7805 OPEN CIRCUIT

-----  
Before replacing the 7805 check the heatsink to see if faulty or badly fitted. Remedy any physical defect in print or damage around screws, etc. Also check the TR4/5 and coil.

#### 6) CONTINUAL FAILURE OF POWER SUPPLY TRANSISTORS

-----  
Ensure that all modifications have been carried out and that the edge connector is O.K. and not loose or damaged. Check for proper fitting of all peripherals and verify that owner is not persistently inserting/removing any of the add-ons, etc. while the computer is switched on. Note that many users are apparently incapable of grasping this simple point. Check the plug/sockets and cable, if not suitable then replace with correct ones. Check the mains and possible interference from other items on same circuit.

If satisfied then check if the 0v is correct on earth. Monitor the 0v while running computer as this may show up an intermittent voltage fault. A systematic check on all capacitors/resistors to earth should find the culprit for this uncommon cause.

#### 7) KEYBOARD FAULTS

-----  
It is recommended that keyboards are better replaced completely since they take a lot of battering and replacement is quite inexpensive. If it is decided that the keyboard is worth repairing then the diagram will show which tail is faulty according to keys in error.

If the entire keyboard is non-functional then check the 5v supply is reaching it O.K. before replacing the ULA I.C. Probably the commonest fault lies with a faulty 10K resistor (R65 to R69) easily identified according to which keyboard column is faulty.

#### 8) VARIOUS FAULTS WHICH APPEAR ONLY WHEN WARM

. Check heatsink thoroughly. If heatsink is O.K. then the ULA I.C. IC1 will be the cause. If IC1 has been replaced before it may be worth adding extra heatsink for it. See also following symptom.

## 9) INTERMITTENT FAULTS

If such faults show up with a comparatively new Spectrum then it is most likely that they are due to poor contacts/soldering during the manufacturing process. Check all holders and pins for tarnish and dry joints. Replace faulty holders by cutting them out and replacing completely. Check after this for poor contacts or loose contacts, look for items which have been poorly soldered or even where soldering has been omitted. Finally check the boards for hairline cracks and breaks, especially radiating from heatsink screws.

10) TEXAS SN1889 INSTEAD OF LMA889

A few models appeared with the SN version and these may even have been used as replacements during repairs. Although unlikely to find now, if SN types have been used replace completely by LM type.

11) POWER SUPPLY O.K. - COMPUTER NOT WORKING CORRECTLY

If computer is functioning at all check for single RAM failure then multiple RAM failure as already described. If RAMS are O.K. or fault is more serious and RAMS cannot be checked then check if the 5v supply is reaching all I.C.s in order IC1, 2, 24, 23, 3, 4, 26, 25 and 5. Replace the open circuit component cutting off the 5v supply if this is the case.

Faulty or missing sound usually identifies the ULA I.C. IC1 as being faulty and this is the most likely suspect in any case. Flick the clock crystal with your finger, this will quickly determine if it is faulty or not.

Although I.C.s are best checked out systematically using a logic probe or even a 'scope, it is worth noting that after IC1 the most likely culprits are IC2 and IC5, neither of which are particularly reliable and it may even be worth replacing the three automatically as a fast check.

12) PERMANENT I.C. CHECKER FOR LOGIC PROBE USE

If a logic probe is available it is well worth making a table of the results of checking each IC pin with a good computer switched on with keyboard disconnected. Thus when any computer is being tested all that is needed is to compare the readings with your correct set and the different readings will quickly pinpoint the faults.

13) FLICKERING WHITE BACKGROUND - MAY BE CAUSING EYESTRAIN

If resetting the computer doesn't help, which is not uncommon if a CTV is being used, then the only thing is to set up the computer to display a coloured background with white printing. See spectrum manual for this, but green is the most relaxing background. Save this programme and load it every time Spectrum is not being used for games.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104

# ZX81 Tape Controller



*This twin relay output port for the ZX81 gives the computer more control over a cassette recorder via the cassette interface, and avoids feedback problems in loading and saving data. It has other uses, too.*

**By R.A. Penfold**

ALTHOUGH the ZX81's cassette interface has received at least its fair share of criticism, if used correctly with a cassette recorder and tape of reasonable quality it provides fairly reliable saving and loading. However, in some respects this interface is quite crude, and it does not provide any form of tape motor control.

## Controller Operation

This project is basically just a twin relay output port for the ZX81, and it is primarily intended as an aid to loading and saving, although it can be used in many other ZX81 applications which require a twin relay port.

If we consider the relay switching first, one of the relays has a single make contact which is used to activate the motor of the cassette recorder. The other relay has double pole changeover contacts, and these are arranged so that normally the earphone socket of the recorder is connected through to the "Ear" socket of the ZX81, but the microphone socket of the recorder is disconnected from the "Mic" socket of the ZX81.

In order to load a program it is just a matter of activating relay 1 so that the motor in the recorder is switched on, and then switching this relay off again once the program has been successfully loaded. In order to save a program both relays must be switched on, and then off again

once their program has been saved. No plugging and unplugging of the microphone and earphone leads is needed as this is effectively done by relay 2.

The circuit which drives the relays is fairly conventional ZX81 2-bit output port. An address decoder circuit decodes only line A13 to A15, plus the MEMRQ line so that the port is placed in ZX81's memory map rather than in its input/output map. This is done simply because ZX81 BASIC language does not include IN and OUT instructions, and input/output devices can only be operated from BASIC using PEEK and POKE in conjunction with memory mapping.

The decoded output is used to control two data latches which are fed from lines D0 and D1 of the data bus. The latched outputs drive the relays via conventional single transistor relay drivers. The address decoder is also used to disable the ZX81's ROM which would otherwise interfere with the output port.

## The Circuit

Figure 2 shows the full circuit diagram of the ZX81 Tape Controller Unit. The address decoder is based on IC1, which is a 74LS138 three-to-eight line decoder. In this circuit the three address inputs are fed from lines A15, A14, and MEMRQ, while the positive enable input of the device is used to decode A13. IC1 also has

two negative enable inputs, but these are not needed in this circuit and are simply connected to the negative supply rail so that they are permanently enabled.

Only output 0 at pin 15 of IC1 is utilized in this design, and this output goes low when A14, A15, and MEMRQ are low and A13 is high. In other words, when any address in the range 8192 to 16383 is accessed.

If it is a positive pulse that is required to operate both the data latches and the ROMCS line, and Q1 is used as an inverter to convert the output of IC1 to a signal of the correct polarity.

The output of Q1 is used to directly drive the clock pulse input of the data latches, but it drives the ROMCS line via diode D1. The reason for disabling the ZX81's ROM is that only partial address decoding is used in the ZX81, and apart from its base addresses, the ROM appears at various address blocks throughout the 64K address range. Taking the ROMCS line high disables the ROM, so that an address block occupied by one of these "ROM echoes" can be used for other devices.

However, internal circuits of the ZX81 operate the ROMCS line, and must not be prevented from doing so by external circuits, or the computer will "crash". D1 is therefore included in series with the output of the ROMCS line so that Q1 can pull this line high when a suitable address

is accessed, but it does not hold it low at other times.

IC2 is the data latch, a 74LS174 device. It is actually a hex D-type flip flop, but it works well in this application, and the four unused flip flops are just ignored. R3 and C1 are used to provide a negative reset pulse to the "master reset" terminal at switch-on. This ensures that initially both relays are in the off state.

The relay driver circuits have Q2 and Q3 as standard common emitter switches, with the usual protection diodes (D2 and D3) in their collector circuits. The main circuit is supplied with power by the stabilised 5 volt output of the ZX81. A 5 volt supply is inadequate for most relays, and the non-stabilised 9 volt (nominal) output of the ZX81 is therefore used to supply the relays and their drivers.

The relay switching circuit is exactly the same as the arrangement outlined in Figure 1 and described earlier. An important point to note is that neither side of the motor control output (SK1) connects to the earth rail. With most cassette recorders neither of the remote control terminals connect to earth, and connecting either terminal to this rail usually prevents the remote control facility from operating (and could even damage the recovery).

The total current consumption of the circuit is under 100 milliamps, even with both relays switched on, and the ZX81 is readily able to supply a current of this modest magnitude.

## Construction

The plastic case having approximate outside dimensions of 150 by 80 by 50 millimetres is adequate to comfortably accommodate all the components. The suggested front panel layouts can be seen by referring to the photographs.

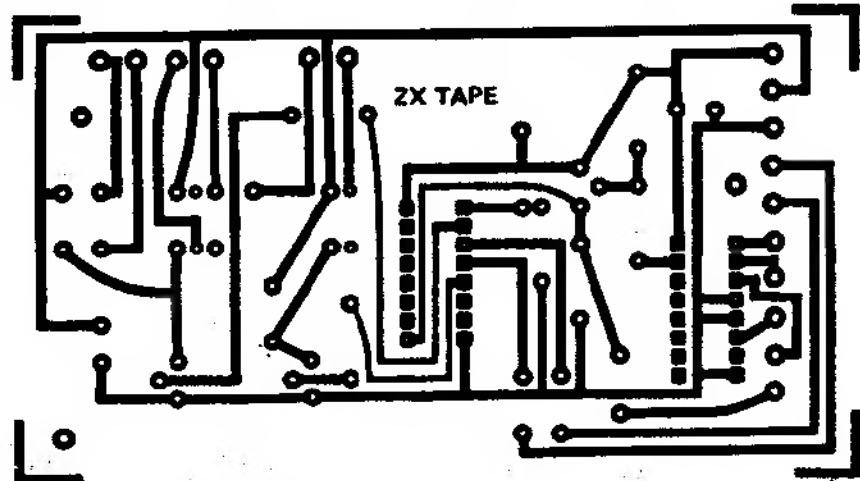


Fig. 1 The PCB for the tape controller.

It is advisable to have the two sockets which connect to the ZX81 well separated from the three which connect to the cassette recorder so that the unit is easily wired into the system without making any errors.

As explained previously, neither side of SK1 must be allowed to come into electrical contact with the ground rail. What this means is that either a metal case must not be used, or SK1 must be an insulated type (or insulated from the metal case). In practice it is probably best to use a plastic case and avoid any insulation problems with SK1.

## Relays

A slight problem has arisen since this project was originally designed: the PCB for the tape controller calls for relays which are no longer manufactured. We apologize for this inconvenience but things like this do happen. To overcome the problem, there are two possible solutions.

The first, although we don't recommend this method unless you're really keen, is to rework the PCB artwork to suit the recommended relays. This could (and does) involve a considerable amount of time and effort.

The solution which we recommend is to wire the two relays off-board. This is a somewhat unorthodox (and untidy) method but a workable solution none the less. A larger case will probably be required to house the completed unit and care must be taken with the off-board wiring to the relays.

A suitable substitute for RLA1 is the Potter & Brumfield type R50S-E2 Y1 or Radio Shack #275-003. The substitute for RLA2 is a Potter & Brumfield type R50S-E2 Y2. The P & B relays are available from Electro Sonic Inc., 1100 Gordon Baker Rd., Willowdale Ont., M2H 3B3, (416) 494-1555. As well, any relay that will operate reliably on a supply potential of about 9 volts, with a coil resistance of

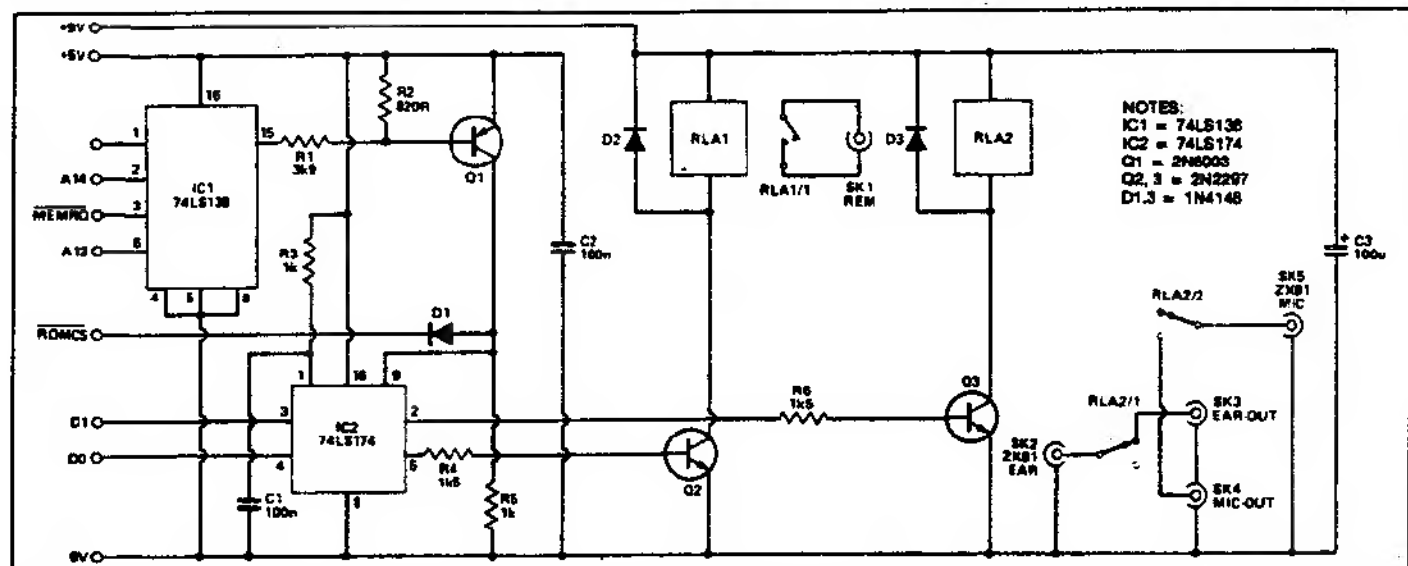


Fig. 2 The Circuit Diagram of the ZX81 Tape Controller. Power is supplied by the computer.



